

Abdomen sessile (rarely petiolate); submarginal vein not very short, the postmarginal vein *always* wanting.

Stigmal vein nearly obsolete, its knob sessile or subsessile; mesopleura without a distinct femoral furrow.

Subfamily II. Aphelininæ.

Stigmal vein distinct and moderately long; mesopleura always with a distinct femoral furrow.

Subfamily III. Tetrastichinæ.

Submarginal vein entire, not broken before uniting with the marginal vein, and usually distinctly longer than the marginal; stigmal vein long, distinct, rarely very short, the postmarginal vein always present.....Subfamily IV. Eulophinæ.

FAMILY LXXII.—TRICHOGRAMMIDÆ.

Wings without regular rows of hairs.....Subfamily I. Oligositinæ.

Wings with regular rows of hairs.....Subfamily II. Trichogramminæ.

FAMILY LXXIII.—MYMARIDÆ.

Tarsi 5-jointed.....Subfamily I. Gonatocerinæ.

Tarsi 4-jointedSubfamily II. Mymarinæ.

Commenting upon this classification, Mr. Howard stated that, in his opinion, the Signiphorinæ, which Mr. Ashmead had made a subfamily of the Encyrtidæ, should be given family rank, a conclusion which Mr. Ashmead was hardly prepared to accept, remarking that he had only adopted Mr. Howard's published views in making it a subfamily.

—Mr. O. F. Cook presented the following paper :

HUBBARDIA, A NEW GENUS OF PEDIPALPI.

By O. F. COOK.

The family Hubbardiidæ* differs from all other Pedipalpi in hav-

* While this paper is passing through the press (March, 1899) it is found that the generic name *Schizonotus* Thorell, on which the family designation Schizonotidæ was based, was preoccupied by Ratzeburg in 1852, although omitted from Scudder's "Nomenclator." A change being thus necessary, I am deeply gratified at the opportunity of suggesting the use of the name Hubbardiidæ, as a further tribute of respect and admiration for the recently deceased discoverer of Hubbardia.

To replace *Nyctalops* Cambridge (Ann. and Mag. Nat. Hist., 1872 (4), X, p. 410), and *Schizonotus* Thorell (Ann. Mus. Civ. Genova, 1888, XXVI, p. 358) the name *Schizomus* is proposed, with *S. crassicaudatus* (Cambridge *l. c.*, p. 411), as type. Instead of *Tripeltis* Thorell (Ann. Mus. Civ. Genova, 1889, XXVII, p. 554), which was also preoccupied (Cope,

ing the cephalothorax separated into parts by a transverse membranous suture. In *Schizomus* there are two divisions, a large ovoid anterior, and a small, transversely oblong posterior, to which the third and fourth pairs of legs are attached. In *Triplomus* the posterior plate is subdivided by a median suture into two subquadrate parts, while in *Hubbardia* a pair of small, narrowly subtriangular plates are intercalated in the transverse suture. Although of small size, these are sufficiently large and well chitinized to render it extremely improbable that they have been overlooked in *Triplomus* by such careful arachnologists as Thorell and Kraepelin. The habit is very similar to that of *Triplomus*, the type of which I had the pleasure of seeing at Hamburg last year, through the kindness of Professor Kraepelin, who was then engaged in his revision of the *Uropygi*.

Schizomus was described from Ceylon, and *Triplomus* from Burma. The discovery by Mr. Hubbard of a representative of this group in the desert region of southern California accordingly extends the known geographic distribution of the family to the western continent and to a new zone and climate. That so peculiar a type, which has until this time eluded all collectors, should surrender to Mr. Hubbard is, however, but one of many testimonies to our President's unrivalled ability as a field naturalist, and may, with his permission, bear his name. The formal description follows:

HUBBARDIA, new genus.

Eyes entirely wanting.

Mandibles chelate; movable finger closing outside the produced inferior corner of the large, subquadrate proximal joint; the movable finger is flattened or channelled in the middle below, with the lateral margin entire and the mesial regularly pectinate with closely placed simple bristles; above these is a series of curved, barbed hairs; the inferior corner of the basal joint is produced into a process armed with two large and three or four small teeth; this joint is also provided with numerous long, barbed hairs.

Maxillæ six-jointed and provided with a simple claw; coxæ with long processes clothed on the mesial face with numerous barbed hairs; trochanter moderately produced distad below and armed on its mesial face at the base of this process with a small conical spine, the only prominence of this joint, excepting the somewhat elevated bases of the scattering hairs. Femur, patella, and tibia decreasing in thickness but of subequal length, unarmed except by the prominent bases of hairs, of which the

1886), the new name *Triplomus* is here substituted. The type is *T. grassii* (Thorell, *l. c.*, p. 554, pl. v, fig. 1). These changes in nomenclature have been incorporated in the proof as far as seemed practicable without too extensive recasting.

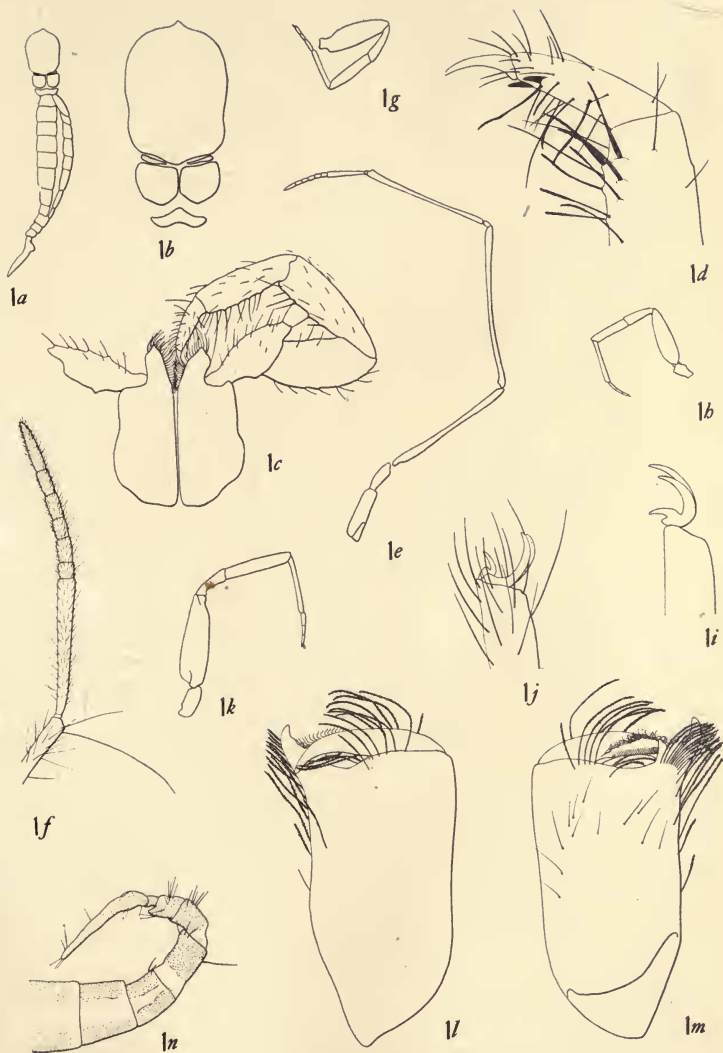


PLATE III.

larger of those of the tibia are barbed. Tarsus with a pair of blunt, conic spines on the ventral face a short distance below the base of the large, simple claw, otherwise armed only with scattering hairs, of which the larger are barbed.

First pair of legs very slender, considerably longer than the body, consisting of 13 joints, the tarsus being 8-jointed; the tibia is subarticulated near the base; the first tarsal joint is very small, the second is nearly half as long as the others taken together; the third is as long as broad, and the others are distinctly longer than broad.

Second pair of legs slightly larger than the third and much smaller than the fourth; the coxa of the second legs bears a large, sharply conic process directed obliquely cephalad and laterad; the coxæ of the other legs are prominent at the distal corner in front but are not produced; the third and fifth joints of the last pair of legs are noticeably larger than in the others, but the femur is not so robust as in *Schizomus*; the metatarsus has its three joints subequal; to the last is movably articulated the three-pronged claw, of which the inferior division is short and is directed downward rather than forward.

Cephalothorax suboval, apiculate in front, divided into five parts, of which the anterior is much larger than all the others; behind this is a pair of small, narrowly subtriangular transverse plates unknown in other genera; these are followed by two others about as broad as long, similar to those of the genus *Triplomus*. Behind this pair of plates is a transverse, subarcuate sclerite which seems to belong to the thoracic rather than to the abdominal region, although previous writers have not so reckoned it.

Abdomen composed of 11 segments and a 1-jointed caudal process; eight of the abdominal segments are separated into two parts by a broad lateral space which is slightly coriaceous, but not chitinized, while the three distal segments are complete rings. The first ventral sclerite is enlarged at the expense of the second, and is much larger than the corresponding dorsal plate. The last segment is produced above into a blunt process.

Caudal appendage of supposed male with a short pedicel bearing a long, narrow, subtriangular body, which tapers from an abruptly enlarged base to a rather blunt apex. As in the other genera, the other sex has this process reduced to a small, upcurved rudiment, not capitate or otherwise enlarged.

HUBBARDIA PENTAPELTIS, new species.

Plate III, figs. 1a-1n.

Length of body of supposed male 11 mm.; width 1.5 mm.; length of cephalothorax 3 mm.; of abdomen 6.3; of caudal appendage 1.7 mm.; of first pair of legs 11.2; the specimen supposed to be a female measures about 6.5 mm. in total length, the abdomen being noticeably shorter and more robust than in the male; this specimen may, however, be immature.

Color of alcoholic specimens a rather bright brown in all the chitinized parts, the shade depending upon the degree of chitinization.

Three specimens of this species, secured by Mr. Hubbard at Palm Springs, California, two males and one female, No. 41, have been examined.

The habits of *Hubbardia* are detailed in the following field notes which show that Mr. Hubbard appreciated at once the novelty and interest of his discovery :

“PALM SPRINGS, CAL., *Febr.* 8, 1897.

“On February 7th I walked up to the mouth of a small cañon from which issues a considerable stream of cold water. . . . Under a stone close to the water I captured a remarkable little Arachnid, very closely allied to *Thelyphonus*, but slender and brown in color, and only about $\frac{1}{4}$ of an inch long. It ran like a ground spider, with its long bristle tail laid over its back. I saw two specimens, but took only one, as I thought at first it was one of those ant-like spiders.”

“PALM SPRINGS, CAL., *Febr.* 13, 1897.

“To-day I found a second specimen of that remarkable Arachnid which lives under débris of leaves or stones near the pools on the shores of mountain streams. My first specimen was about $\frac{1}{4}$ of an inch long; the one I found to-day is half again as large. It is very elongate and slender, and dusky red-brown in color, and has long antennæ-like front legs, the chelicers having but a single visible claw. The small specimen which I found the other day appeared to me to have a long bristle tail closely allied to its back, but when I took it out of the vial the next morning it was tailless. The specimen taken to-day has a most remarkable lanceolate appendage attached by a short and slender articulation to the tip of the long tapering abdomen. The thighs of the hind legs in this specimen are very thick and stout, and undoubtedly the two specimens are different sexes.”

“PALM SPRINGS, CAL., *March* 6, 1897.

“. . . Collected under stones along sides of water courses from Small West cañon and got . . . both sexes, 1 specimen of each of the new Arachnid near *Thelyphonus*.”

In connection with *Hubbardia* it is permissible to refer to another related animal which I had collected in Liberia and presented at a meeting of the Society last year, giving it the name *Artacarus liberiensis*.

A close relationship with *Schizomus* was admitted, but the discrepancies of Cambridge's description (as *Nyctalops*) seemed to forbid reference to that genus.

Learning immediately afterwards that Professor Kraepelin, of Hamburg, was engaged in a revision of the whip-scorpions and

Schizonotidæ, I left my single, somewhat dilapidated specimen with him.

In his "Revision of the Uropygi," Professor Kraepelin includes *Artacarus* under *Schizonotus*, a disposition to which I am unable to assent. Having since secured additional material, I find that the large spine-like processes of the trochanter, patella, and tarsus of the maxilla of the male of *Schizomus*, as described and figured by Professor Kraepelin, do not occur in *Artacarus*.

The posterior sclerite of the cephalothorax has a median suture indicated by a difference of structure and color in the integument, though not membranous as in *Triplomus* and *Hubbardia*. Finally, the caudal appendage of the male is diamond-shaped in outline, not abruptly cordate-capitate as in *Schizomus*.

The genera of Hubbardiidæ are thus four in number; they may be distinguished as follows:

Posterior part of cephalothorax entire; trochanter and patella of maxillæ with a large spine-like process in males: Genus *Schizomus*.

Posterior part of cephalothorax with a median suture; trochanter and patella without such processes in either sex.....

Suture of posterior part of cephalothorax chitinized; flagellum of first pair of legs with the third joint distinctly broader than long, the four following about as broad as long: Genus *Artacarus*.

Suture of posterior part of cephalothorax membranous; third joint of flagellum as broad as long, the others distinctly longer than broad.....

Cephalothorax with transverse suture simple: Genus *Triplomus*.

Cephalothorax with a pair of narrowly triangular chitinous plates lying in the transverse suture: Genus *Hubbardia*.

THE SYSTEMATIC POSITION OF THE HUBBARDIIDÆ.

In *Hubbardia* the segmentation of the cephalothorax is carried a step farther than in the allied genera in the direction of the condition described by Grassi for his truly remarkable *Kænenia mirabilis*, so that it becomes somewhat more probable that that aberrant type can be associated with the subclass Pedipalpi, notwithstanding the fact that the second pair of appendages, the so-called maxillæ of *Thelyphonus* and *Tarantula** function in

*The application of this name has been the subject of much debate, notably between Professor Kraepelin and Mr. Pocock. Linnæus, having a specimen, described a species (*Phalangium reniforme*) which he identified with a form described and figured in Brown's History of Jamaica. This reference Mr. Pocock proposes to employ as the type of the genus *Tarantula* described by Fabricius from a specimen supposed to represent *Phalangium reniforme* Linnæus. Professor Kraepelin properly

Kœnenia as true legs, and are provided with the normal 3-pronged claw. In the structure of these appendages, as well as in that of the cephalothorax, Hubbardia and its relatives are evidently more primitive than either the Thelyphonidæ or the Tarantulidæ, both of which types have specialized beyond the condition in which the Hubbardiidæ remain. The former groups have, by some, been supposed to be connected by the Hubbardiidæ, since these possess a short caudal appendage, and in this respect appear intermediate between tailless and long-tailed forms. The possession of a tail is, perhaps, the chief reason why the Schizonotidæ have been associated by Thorell and Kraepelin with the Thelyphonidæ as a family of a suborder called Uropygi, from which the Tarantulidæ were excluded.

The more salient characters distinguishing the Hubbardiidæ from the Thelyphonidæ have been contrasted by Kraepelin somewhat as follows :

FAMILY THELYPHONIDÆ.

Cephalothorax of a single piece to which all four pairs of legs are attached.

Eyes present, in three widely separated clusters.

Maxillæ 5-jointed, consisting of coxa, trochanter, femur, tibia, and hand, the last chelate, that is, with a movable finger.

Flagellum of first pair of legs 9-jointed.

Tarsi with two claws.†

Abdominal appendage long, jointed.

refuses to interpret the Linnæan species from the reference to Brown, and wishes to take the Linnæan specimen (from the East Indies) as the type of the genus. However, a continuation of the same course of reasoning brings us to the view that the type of the Fabrician genus is the Fabrician *specimen* which Professor Kraepelin has examined and identified as *Phalangium palmatum* Herbst, a congener of Brown's animal, if not, indeed, the identical species. Whether we shall write *Tarantula reniformis* Fabricius or *Tarantula palmata* (Herbst), is still another of the interesting questions attending this nomenclatorial complication.

†In this, as in some other points, I am quite unable to agree with Professor Kraepelin; as far as I have been able to observe, the claws of the three families are not notably different. The large paired claws are certainly the same in all, and to the common base of these is immovably attached the much smaller third, or inferior, claw. This last is best developed in the Hubbardiidæ, but neither in Hubbardia nor in Artacarus does it correspond in size or direction to the claw of Schizomus, as figured by Professor Kraepelin. This drawing is evidently inaccurate, as it represents the claw as continuous with and immovably fixed to the end of the joint, while in reality it is flexibly articulated. Owing to this last fact,

FAMILY HUBBARDIIDÆ.

Cephalothorax transversely divided into two or three sections of unequal size, the third and fourth pairs of legs being attached to the posterior portion.

Eyes wanting or rudimentary.

Maxillæ 6-jointed, consisting of a coxa, trochanter, femur, a long patella, tibia, and hand, the last not chelate.

Flagellum of first pair of legs 8-jointed.

Tarsi with three claws, two dorsal and one ventral.

Abdominal appendage short, curved, or capitate, not jointed.

If now we tabulate in similar form currently accepted characters of the Tarantulidæ, it appears that the points of similarity between the Thelyphonidæ and Tarantulidæ are not less numerous than those which might be alleged between the Thelyphonidæ and Hubbardiidæ.

FAMILY TARANTULIDÆ.

Cephalothorax of a single piece to which all four pairs of legs are attached.

Eyes present in three widely separated clusters.

Maxillæ 5-jointed, consisting of coxa, trochanter, femur, tibia, and hand.

Flagellum of first pair of legs many-jointed.

Tarsi with two claws.

Caudal appendage wanting.

Formal 'characters' like the preceding are, however, frequently of the slightest value as affecting conclusions regarding phylogeny and systematic arrangement.

Thus in the above comparisons I have followed Professor Kraepelin's statements in regard to the maxillæ. I believe, however, that there is no very essential difference in the structure of that member in the three families, and that six joints are in reality present in all. It is easy to see that the large terminal claw of the Tarantulidæ is composed of two parts, the distal of which is smooth, being the true claw, while the hairy proximal portion is a somewhat reduced and strongly chitinized joint with which the claw has become immovably coalesced. The movable finger of the "hand" of the Thelyphonidæ is also evidently a joint and not a claw merely, so that Professor Kraepelin's intercalation of a "long patella" into the maxilla of the Hubbardiidæ seems unwarranted, unless the same joint is to be recognized elsewhere.

the direction of the inferior claw may vary with regard to the axis of the leg, but it is constant in regard to the other prongs of the claw. In Thelyphonus, the inferior claw is shorter than in Hubbardia, while in Tarantula it is reduced to a rounded prominence.

The "patella," "tibia," and "hand" of *Hubbardia* correspond respectively to the "tibia," "hand," and movable dactylus of *Thelyphonus*, and to the "tibia," "hand," and basal part of the claw of *Tarantula*. As far as the number of joints is concerned, the difference is made not by intercalation, but by the fact that the claw of *Thelyphonus* and *Tarantula* has become fused with the distal joint and is no longer movably articulated with it as in *Hubbardia*. Here, however, the apparent similarity ends. In *Thelyphonus*, the distal joint with its movable claw has a vertical motion and is opposed to the produced superior corner of the fifth joint. The superior angles of the second and fourth joints are also strongly produced to assist in the formation of a powerful armature which depends for its efficiency largely upon the cooperation of the two maxillæ. With the exception of the last, none of the joints are, strictly speaking, opposable, a difficulty which the strong processes are evidently calculated to meet.

In *Tarantula*, on the contrary, the distal joint with its adnate claw has a horizontal motion and functions merely as a claw; it is not opposable to the preceding joint, which sends out no process to meet it, but is itself accessory to the prehensory mechanism formed by the third and fourth joints which are armed along both edges of their closely opposable mesial face with a series of large spines. The maxillæ of *Tarantula* are thus adapted to work separately in a manner which would be impossible in *Thelyphonus*. The short distal joints bring the prey against the spines of the long third and fourth joints which hold and impale it. The third joint in *Thelyphonus* is not specialized in the formation of the prehensory apparatus, but the second joint plays an important role with its powerful dentate processes. In *Tarantula* the third joint is second only to the fourth in size and specialization, while the second is reduced to a comparative rudiment. The complete difference in the mechanical principles and construction of the maxillæ in the two groups is further emphasized by the fact that the coxæ are adnate in *Thelyphonus*, but free in *Tarantula*. This condition permits in *Thelyphonus* the development of a muscular system for increasing the power of lateral prehension *between* the maxillæ, while the independent action of the parts in *Tarantula* requires no such basal modification, the chief muscular strain occurring in the opposition of the fourth joint with the third.

It is accordingly evident, in spite of the general similarity of the maxillæ, that these appendages offer, in the two families considered, no details indicating a common origin from a form with specialized maxillæ. Although having similar habits and occupying much the same place in the economy of nature, the *Thelyphonidæ* and *Tarantulidæ* have evidently achieved their present efficiency on two independent lines of development, and

it is manifestly illogical to associate with either of them a family which has not even entered upon similar development. The maxillæ of *Hubbardia* are still almost unmodified legs compared with those of either *Thelyphonus* or *Tarantula*. They stand in the vertical rather than in the horizontal plane; the claw is not coalesced with the distal joint; the joints are none of them truly opposable, and the armature is very slight and offers no evident homology to that of either *Thelyphonus* or *Tarantula*. Agreements and differences in other characters do not seriously affect the case, since there is no evidence to prove that the *Hubbardiidæ* are degenerate *Tarantulidæ* or *Thelyphonidæ*. The segmented cephalothorax once coalesced could not be expected to redivide, and the maxillæ once rendered effective by specialization would scarcely return to the primitive and undifferentiated condition of the ambulatory leg.

The *Pedipalpi* consist, then, if *Kænenia* be included, of four very natural and compact groups of animals which by their diversity of structure and developmental history demand recognition as of more than family rank. With reference to the anterior appendages alone these groups may be distinguished as follows:

Second and third pair of thoracic appendages ambulatory in structure and function, and provided with three-pronged claws: Order *Microthelyphonida*, family *Kæneniidæ*.* *

Second appendage modified to assist in feeding, and provided with a simple claw; third pair of appendages modified into tactile organs, without claws

Second pair of appendages vertical, with a movable claw: Order *Colopyga*.

Second pair of appendages horizontal, the claw immovably soldered to the last joint.....

Second pair of appendages adnate at base; last joint with a vertical motion permitting opposition with a process of the preceding; other joints not opposable; third pair of appendages with a 9-jointed tactile flagellum: Order *Uropyga*.

Second pair of appendages free at base; last joint with a horizontal motion, not opposed to the preceding; third and fourth joints closely op-

* According to Grassi, his *Kænenia mirabilis* (*Naturalista Siciliano*, 1885, iv, p. 127), the palpi (maxillæ, second appendages) are 9-jointed, the cephalothorax is divided by two transverse sutures into three segments, of which the last is narrowed to form a sort of peduncle for the distinct abdomen; the abdominal rings are ten in number, and are without lateral sutures, and there is a long, slender, 13-jointed tail. Grassi bestowed the name *Microthelyphonida* for the order, for which Thorell has proposed a substitute in the form of "Palpigradi."

posed, provided with two rows of large spines; third appendages with distal joints broken up into very numerous minute articulations: Order Amblypyga.

In canvassing the question of the recognition of these groups as orders, it has been found that the points of agreement between any two or three of them have usually been common also to other Arachnida outside the Pedipalpi here recognized as a subclass. Notwithstanding the valuable suggestions of Pocock,* it does not appear that the isolation of the various arachnid major groups has even yet been appreciated. With some naturalists the fact that a group is small or monotypic is a reason for refusing to recognize it as of high rank systematically. Although Mr. Pocock is seldom open to criticism from this standpoint, it does not appear that the second subclass into which he would divide the Arachnida is a natural group, nor is he able to give it more than a negative characterization. It will be difficult to arrange the numerous groups into any such number of major subdivisions or subclasses, as most writers are now willing to admit. Morphological and embryological investigations will furnish light as to the affinities of the various types, but cannot be expected to dispose of the evident differences, or supply connecting links which nature has refused to preserve. The discovery of Hubbardia is, indeed, a reminder that all the returns are not yet on file, but it is nevertheless improbable that many important types remain uncollected.

Omitting the mites, the affinities and autonomy of which remain altogether uncertain, it does not appear that the Arachnida can be logically accommodated under less than six primary subdivisions. From their most striking peculiarities these may be briefly characterized as follows:

Abdomen provided with pectines and ending in a sting, which includes a pair of poison-glands: Subclass Toxicura,† order Scorpiones.

Abdomen without pectines, sting, or poison-glands.....

Thoracic stigmata present; posterior legs with a row of large, obliquely T-shaped tactile organs; claws pedicellate: Subclass Mycetophora, order Solifuga.

Thoracic stigmata wanting; posterior legs without such tactile organs; claws sessile.....

With jointed, paired, abdominal spinning-organs; palpi of males modified to assist in copulation: Subclass Maripalpi, orders Araneina, Mesothela.

Without paired abdominal appendages; palpi of males not utilized as copulatory organs.....

* Ann. and Mag. Nat. Hist., 1893, Ser. 6, vol. xi, p. 11.

† A new name to replace Ctenophora Pocock, already in use for a major group in Zoölogy.

Copulatory organs external, borne by the third (penultimate) pair of legs: Subclass Podogona, orders Rhignogastra, Meridogastra. (?)*

Copulatory organs, if present, concealed within the body.....

Body distinctly constricted between the thorax and abdomen; tracheæ lamellar: Subclass Pedipalpi, orders Microthelyphonida, Colopyga, Uropyga, Amblypyga.

Body not constricted; tracheæ tubular: Class Holosomata, orders Opiliones, Cyphophthalma, Pseudoscorpiones.

EXPLANATION OF PLATE III.

Hubbardia pentapeltis.

- Fig. 1a. Body without appendages.
 1b. Cephalothorax, more magnified.
 1c. Maxillæ, from below.
 1d. Maxilla, distal portion.
 1e. First leg.
 1f. Distal joints of same more magnified.
 1g. Second leg.
 1h. Third leg.
 1i. Claw of second leg.
 1j. Claw of third leg.
 1k. Fourth leg.
 1l. Mandible, lateral face.
 1m. Mandible, mesial face.
 1n. Caudal segments, lateral view.

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JANUARY 6, 1898.

Vice-President Gill occupied the chair, and Messrs. Schwarz, Fernow, Marlatt, Wait, Mann, Pratt, Benton, Curry, Kenyon, Motter, Patten, Ashmead, Dyar, Johnson, Chittenden, Heide-
 mann, and Howard, active members, and Soltau, correspond-
 ing member, also present.

—Under the head of "Short Notes and Exhibition of Specimens," Mr. Howard stated that a small Agrionine apparently belonging to the genus *Telagrion* had been received by him from

* Although perhaps related, it is evident that *Anthracomartus*, the fossil type of Karsch's order *Anthracomarti* (for which the name *Meridogastra* has been substituted by Thorell) is very far distant from the existing form *Cryptostemma*, for which the order *Rhignogastra* is established. I have had the opportunity of collecting and observing alive this exceedingly rare and interesting genus.